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NASA LAUNCH SERVICES PROGRAM

**2015 ASTROPHYSICS EXPLORERS
SMEX AND MO KICKOFF**

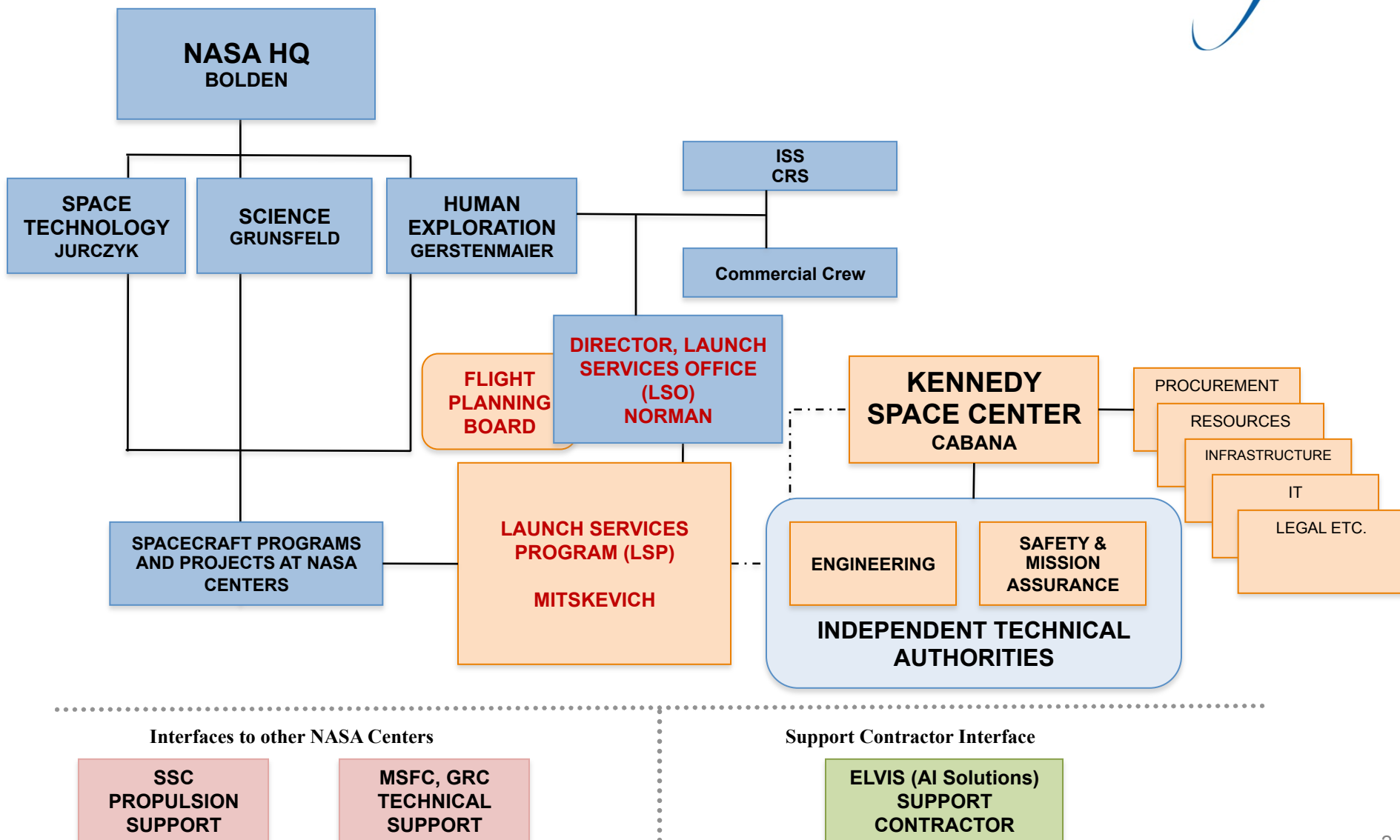
AUGUST 24, 2015

**Alicia Mendoza-Hill
Flight Projects Office**



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Launch Services Program Relationships (NASA/HEOMD/KSC)



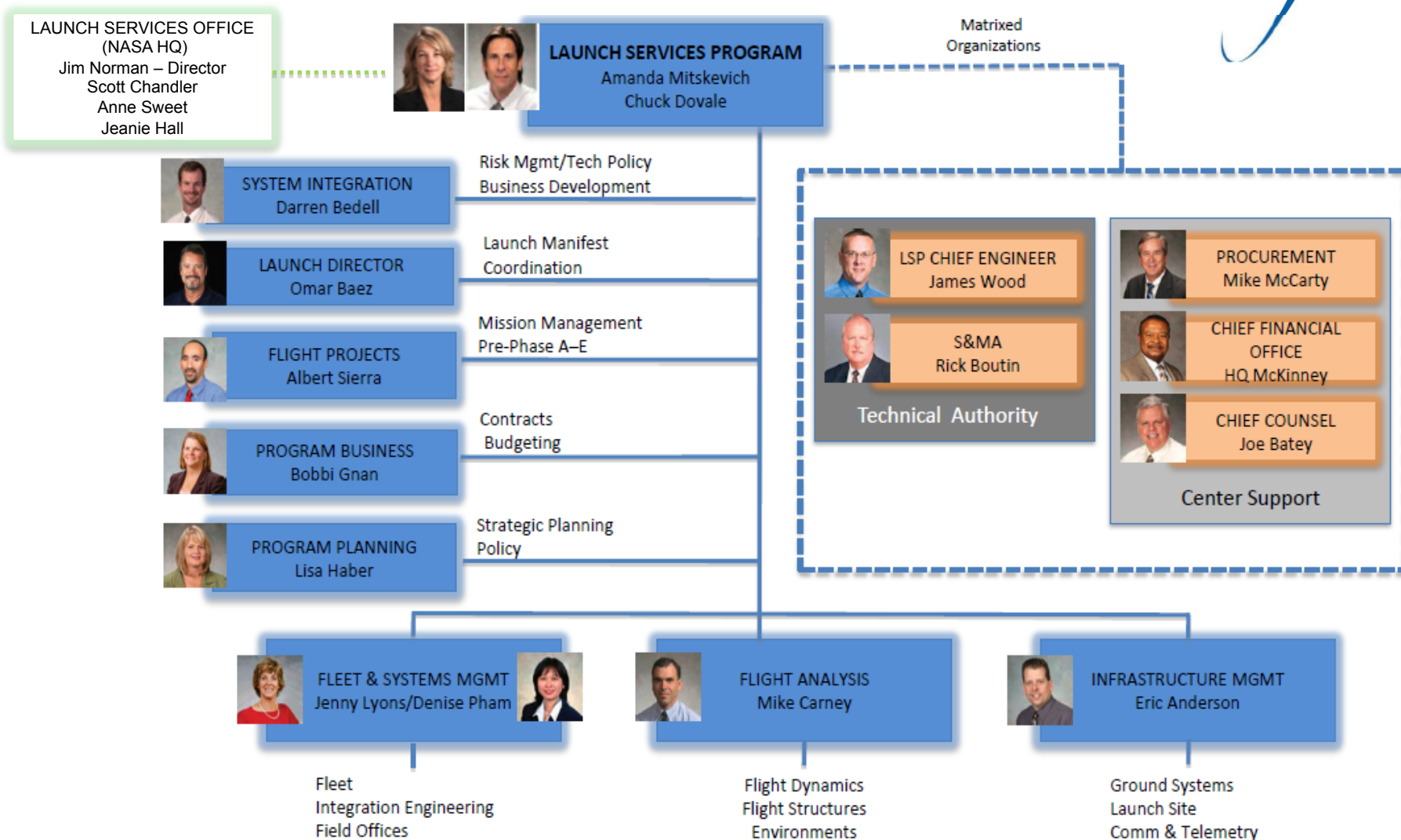


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LSP Organizational Structure



LAUNCH SERVICES PROGRAM





Launch Services Program



NASA Strategic Plan 2014

Strategic Goal 3:

Serve the American public and accomplish our Mission by effectively managing our people, technical capabilities, and infrastructure.



Objective 3.2:

Ensure the availability and continued advancement of strategic, technical, and programmatic capabilities to sustain NASA's Mission



Key Strategy:

Provide access to space

Lead Office: **HEOMD**

Contributing Program: **LSP**

Key Strategy "Provide access to space" citation:

"...certify and procure domestic commercial space transportation services for the launch of robotic science, communication, weather, and other civil sector missions"

"...provide robust, reliable, commercial and cost-effective launch services"

"...assured access to space through a competitive 'mixed Fleet' approach utilizing the breadth of U.S. industry's capabilities"



LSP Strategic Goals 2014

Goal 1: Maximize Mission Success

Goal 2: Assure Long-Term Launch Services

Goal 3: Promote Evolution of a U.S. Commercial Space Launch Market

Goal 4: Continually Enhance LSP's Core Capabilities





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Launch Services Program



The Launch Services Program provides

- **Management of the launch service**
- **Technical oversight of the launch vehicle production/test**
- **Coordination and approval of mission-specific integration activities**
- **Mission unique launch vehicle hardware/software development**
- **Payload-processing accommodations**
- **Launch campaign/countdown management**



LSP Functional Structure



- LSP procures/provides a Launch Service
 - Its more than the basic launch vehicle
 - We don't buy a tail number
 - This is a commercial FFP procurement with additional insight and oversight
- To enable this, LSP has two functional sides
 - Mission integration
 - » Mission Integration Team (MIT) assigned to each mission
 - » Manages mission specific procurement, integration, and analysis
 - » Includes launch site integration and processing
 - Fleet management
 - » Personnel assigned to each contracted rocket
 - » Includes resident offices within the production facilities of all active providers
 - » We watch the production and performance of entire fleet – we certify the manufacture's production line, not just a particular unit (tail number)
 - » We have a say in any change/upgrade/anomaly
- LSP maintains the final go or no-go for launch
- Interface with Safety and Mission Assurance
 - Safety
 - Quality

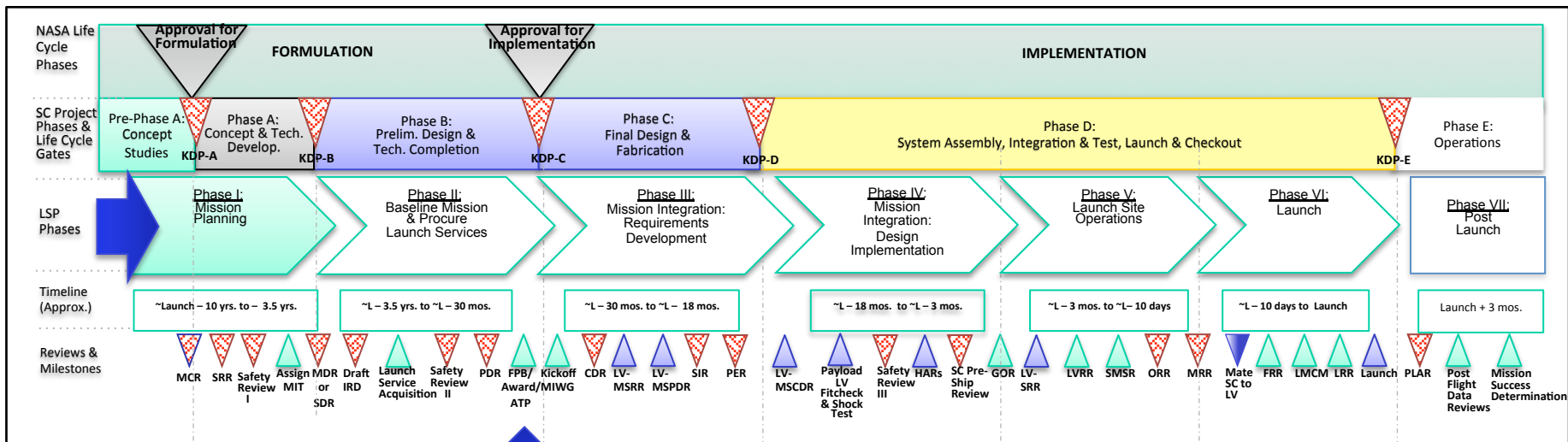


Launch Service Procurement



- Any acquisition of a non-contributed domestic expendable launch vehicle proposed for this AO will be procured and managed by the NASA Launch Services Program (LSP) via the NASA Launch Services II (NLS II) contract.
- The LSP will competitively select a launch service provider for these missions based on customer requirements and NASA Flight Planning Board (FPB) approval.

LSP Mission Life Cycle



Spacecraft reviews shown in red.



NLS II Contract Overview



- The NLS II Contract is LSP's primary method to acquire all classes of Category 2 and Category 3 commercial launch services for spacecraft customers
 - Provides NASA with domestic launch services that are safe, successful, reliable, and affordable
 - Provides services for both NASA-Owned and NASA-Sponsored payloads through multiple Indefinite Delivery Indefinite Quantity (IDIQ) Launch Service Task Order (LSTO) contracts with negotiated Not To Exceed (NTE) Prices
 - Provides services on a Firm-Fixed-Price (FFP) basis
 - » Incorporates best commercial practices to the maximum extent practical
 - » Includes Standard and Non-Standard services
 - » Mission unique modifications
 - » Special studies
 - Allows LSP to turn on a Task Assignment or Non-Standard Service at any time for analyses



NLS II Contract Overview – Cont'd



- Launch Services Risk Mitigation Policy for NASA-owned and/or NASA-sponsored Payloads/Missions can be found under NPD 8610.7. Document can be found at <http://nodis3.gsfc.nasa.gov>
 - Risk Category 1: Low complexity and/or low cost payloads-Classified as Class D payloads pursuant to NPR 8705.4
 - Risk Category 2: Moderate complexity and/or moderate cost payloads-Classified as Class C payloads and, in some cases, Class B payloads, pursuant to NPR 8705.4
 - Risk Category 3: Complex and/or high cost payloads-Classified as Class A payloads and, in some cases, Class B payloads, pursuant to NPR 8705.4
- NLS II Launch Service Costs
 - Acquisition process begins at approximately L-36 months
 - Authority to Proceed (ATP) concurrent with Task Order Award at approximately L-30 months
 - \$50M from the PI-Managed Mission Cost is allocated to the Explorer Program to pay all standard and some mission unique launch service costs
 - Costs not covered by the Explorer Program include
 - » Launch delay costs
 - » Some non-standard services such as a payload isolation system or costs due to a requirement for a unique launch site may require additional funding



NLS II Contract Overview – Cont'd



- Each Provider has their own unique Launch Delay Table
 - Delay terms are identical for both parties (Contractor/NASA)
 - No-fault Launch delays
 - » Include: range constraints, floods, acts of God, strikes and other conditions
 - » No adjustment made to mission price
 - » No limit on number of days
- For the remaining delay cases grace days are based on sliding scale for both Contractor and NASA delays
 - 150 days of grace at ATP through L-24
 - Sliding down to 7 days of grace at L-10 days



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NLS II Launch Service Task Order (LSTO) Process



- Launch service selection is the responsibility of the LSP
- The Task Order Selection Official (TOSO) is the LSP Program Manager
- LSP initiates the LSTO process upon direction from the NASA Flight Planning Board (FPB)
- The LSTO process provides NLS II contractors an opportunity to be considered for task orders based on specific mission requirements through a released Request for Launch Service Proposal (RLSP)
- Nominal schedule for an LSTO is 6 months; from RLSP release to LSTO award and ATP
 - Draft RLSP adds 2 to 3 weeks to 6 month schedule
- LSTO award is based on a best-value assessment, considering technical capability/risk, price, and past performance
 - The relative importance of these evaluation factors is established in the RLSP
- Upon completion of the evaluation the LSTO Manager will present findings to the FPB
- The FPB will provide input to the TOSO
- The TOSO makes the launch service selection
- The LSTO is awarded and ATP'ed



Available Vehicles under NLS II



- Assumption of a specific launch vehicle configuration as part of this AO proposal will not guarantee that the proposed LV configuration will be selected for award of a launch service competitive procurement
 - Firm technical rationale for sole source justification is required in the proposal, and NASA would have to obtain appropriate approvals
- The Agency policy, NPD 8610.7, “Risk Mitigation Policy for NASA-Owned and/or NASA-Sponsored Payloads/Mission” has been modified so newer launch service providers are eligible earlier to compete for any of NASA’s missions

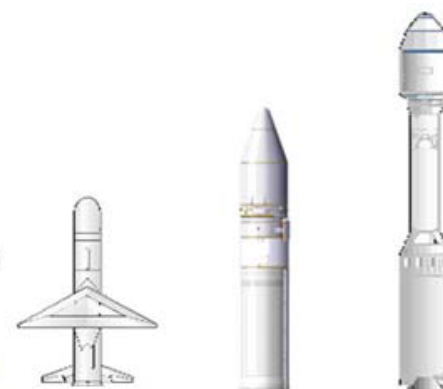


Available Vehicles under NLS II – Cont'd



- Most likely candidate vehicles for the SMEX AO that are available on the NLS II contract are
 - Pegasus XL
 - Athena 1C
 - Taurus XL
- Bidders must remain compatible with vehicles that provide their performance requirements
- LSP uses the NLS II contract and not the launch vehicle providers users guides when determining LV configurations and performance

Performance shown below rounded down to nearest 50kg in the Small class and nearest 100 kg in the Medium and Intermediate classes. For detailed performance data see <http://elvperfor.ksc.nasa.gov>



Vehicle Class	Small		
Launch Vehicle	Pegasus XL	Athena 1C	Taurus XL
Offeror	OSC	LMSSC	OSC
Perf@ 600 km Sun Synch	200 kg	300 kg	800 kg
Certification Category	Cat 3	n/a	Cat 2
Launch Sites	CCAFS WFF KWAJ VAFB	CCAFS KLC WFF	CCAFS WFF VAFB



Performance by Launch Site



Table 1 Representative Launch Site Inclinations and Available Altitude Ranges

Launch Site	Assumed Inclinations	Altitude Range
CCAFS	28.5° - 51.6°	200 km - 2000 km
RTS	0° - 20°, 60°	200 km - 2000 km
VAFB	70° - 90°, Sun-synch	200 km - 1200 km
Kodiak	70° - 90°, Sun-synch	200 km - 2000 km
WFF	38° - 51.6°	200 km - 1300 km

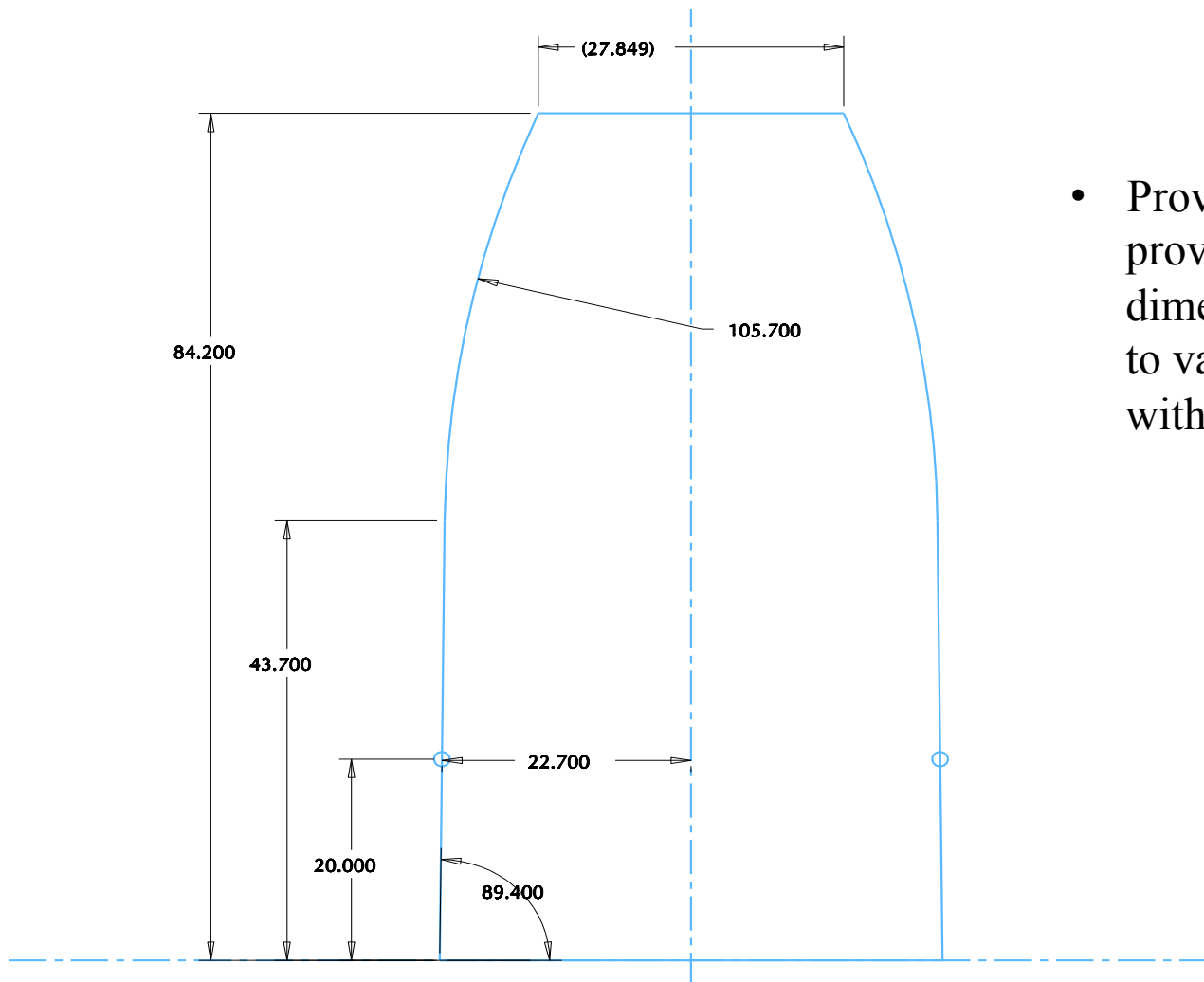
- The LV performance available on NLS II generally does not include impacts associated with orbital debris compliance; this must be evaluated on a mission-specific basis. Depending on LV design/configuration, this could result in a significant performance impact for missions to ensure full compliance with orbital debris policy.
- Guidance reserves have been allocated to account for 3-sigma flight performance
- Performance is for a baseline LV configuration; non-standard, mission-unique hardware will require additional assessment
- 38-inch (0.96-meter) separation system
- Mass of entire separation system is book-kept on the launch vehicle side



Payload Fairing Static Envelope



Figure 1 Static Envelope (in.) – Limiting Case



- Providers should provide sufficient S/C dimensions in proposal to validate they fit within the PLF envelope



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Launch Service Budget



- Under a NASA provided Launch Service a standard launch service includes:
 - The launch vehicle, engineering, analysis, and minimum performance standards and services provided by the NLS II contract.
 - Mission integration
 - Launch Site Payload Processing
 - Range Support
 - Down Range Telemetry support (launch vehicle only)
 - Standard Mission Unique LV modifications/services – these are items typically necessary to customize the basic vehicle hardware to meet spacecraft driven requirements. Already budgeted for are items like Pre-ATP studies such as coupled loads and/or trajectories analysis, a GN2 or pure air purge prior to T-0 and 10,000 Class integration environment.
 - Potential additional funding needed to support selectees requiring launch from sites other than the LV base launch complex
- The LSP LV Budget does not include funding for launch delays



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Example Non-Standard Services Costs



Additional Options	Launch Date NLT	Total (\$M)
Mission Unique Adapter	12/20	1.21
Payload Isolation System*	12/20	1.83
Supplemental Propulsion**	12/20	Proposer Provided

* Bidders may choose to provide their own isolation system.

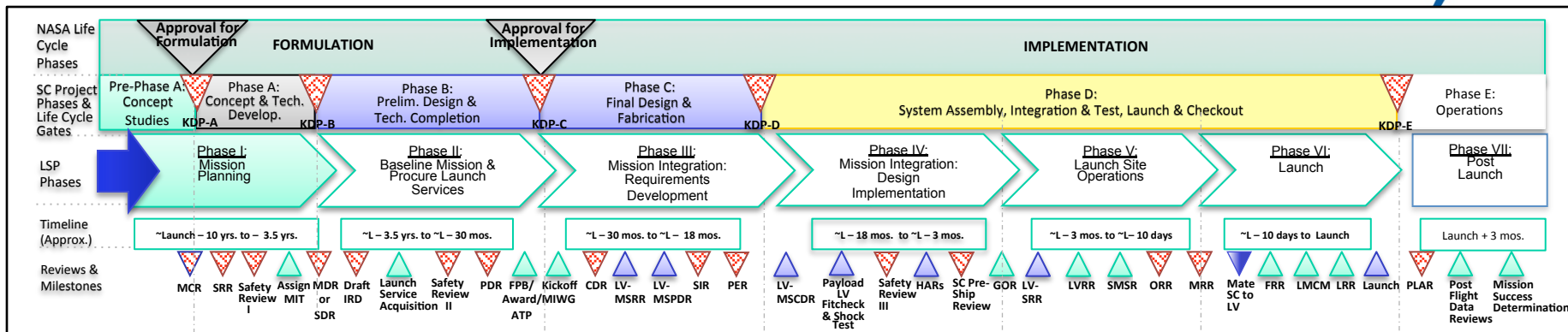
** Due to the multiple launch vehicle configurations within this launch vehicle class, supplemental propulsion systems must be defined and provided by the proposer to meet mission requirements. The system proposed and the spacecraft shall remain within the fairing envelopes provided.



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LSP Mission Life Cycle

(Business Operating Success Strategies - BOSS)



Phase Overview

The Mission Planning Phase involves a significant level of integration activity between the Spacecraft project and LSP to ensure that spacecraft requirements and interfaces can, when possible, be tailored to maximize use of existing vehicle and ground support capabilities while minimizing costs associated with additional development products and mission risks. During this phase, the LSP Mission Integration Team (MIT) personnel assists the Spacecraft Project throughout the development of the Spacecraft Interface Requirements Document (IRD), which defines the spacecraft requirements levied on LSP for vehicle services and launch site facilities and equipment. Information discovered in the beginning of the IRD development includes: the spacecraft/payload mass/volume, orbital requirements, target launch data and science window, and any unique spacecraft design considerations. The IRD is eventually used for competition of a launch vehicle, and estimates for advanced budget funding profiles for the Planning, Programming, and the Budgeting & Execution (PPBE) process.

In addition, Technical Interchange Meetings (TIMs), involving both Spacecraft Project and LSP personnel, are forums to review specific requirements against both vehicle capabilities and implementation options. Preliminary design planning may result in more than one type of launch vehicle being carried as options during portions of this period, with performance levels, costs, and risks being key factors in the trade studies leading up to the finalized IRD requirements. By considering multiple options, the mission team maximizes the opportunity to procure a launch service competitively.

Intent of Phase

- Refine spacecraft customer requirements.
- Refine budget estimates.
- Develop the LSIRD to be used for LSTO activities.

Significance of Phase

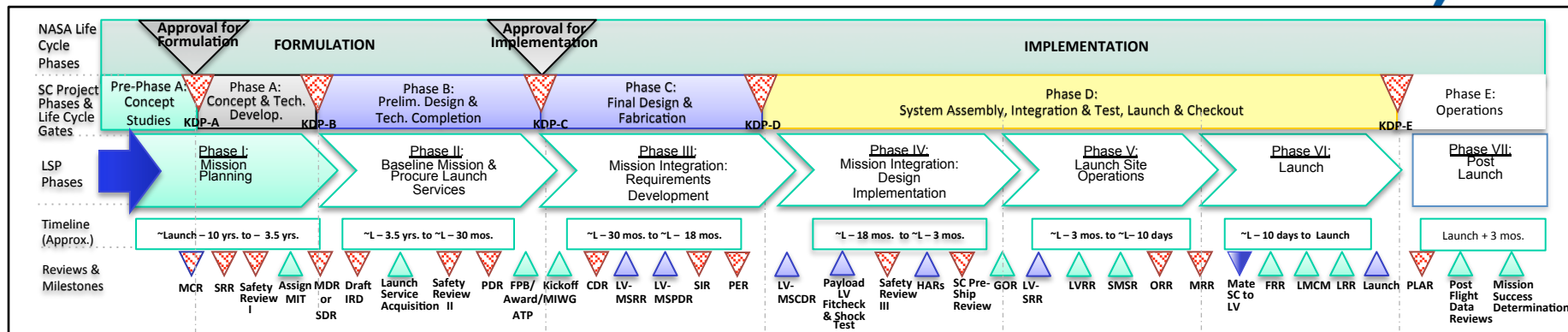
- Establish long lead items and prepare acquisition strategy and/or schedule for the launch service



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LSP Support to Spacecraft Projects

LSP Phase I: Mission Planning
[~Launch – 10 yrs. to – 3.5 yrs.]



Early LSP Capabilities

- Answer early SC Questions
- Evaluate AO proposals
- Support Pre-Proposal conferences
- Support early Spacecraft meetings:
 - Spacecraft Project Kick-off
 - Mission MCR
 - Mission SRR
 - Mission MDR
 - Other reviews/meetings as requested
- Provide budget estimates to NASA HQ for Mission Launch Services
- Provide guidance on development of the IRD
- Provide guidance on participation in LSTO process
- Support early spacecraft development
 - Facilitate /Perform Vehicle Trade Studies & early analyses (i.e. CLA, trajectory or other mission analysis)
 - LSP could perform some early analyses internally
 - Provide LV technical insight to SC as requested

Major Deliverables developed in this phase

- Interface Requirements Document (IRD)-Initial draft
- Spacecraft Safety Data Package (SDP) I
- Systems Safety Program Plan (SSPP) Inputs
- Prepare Payload Safety Introduction Briefing (PSIB) to Range/KSC Safety (aka Concept Briefing)
- LSP Mission Plan for SC Project further developed and shared with SC.
- LSP Communication Plan shared with SC Project.



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Summary



- It is the Launch Service Program's goal to ensure the highest practicable probability of mission success while managing the launch service technical capabilities, budget and schedule.
- Additional information including performance quotes, mission integration inquiries and costs must be officially submitted to the LSP contact below:

Bruce E. Reid
Mission Manager
NASA Launch Services Program
Code VA-C
Kennedy Space Center, FL 32899
Phone: 321-861-8119
Email: Bruce.E.Reid@nasa.gov

LSP is ready to respond to your mission specific questions!!



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Back Up



Evaluation



- Launch Service Technical Evaluation:

- Overall Assessment: - Given the ground rules in the AO, is the proposed launch vehicle (LV) concept feasible for this application? (Yes or No)

–

Comments: _____

- LV Performance: Area of concern (Yes or No)

- Proposed LV configuration: _____
- Proposed Launch Date: _____
- Launch Period (MM/DD/YYYY to MM/DD/YYYY): _____/_____/_____ to
_____/_____/_____
- Launch Window (On any given day of the launch period
Minutes:Seconds): _____ : _____ .



Evaluation



- LV Performance: Area of concern (cont)

- Orbit requirements: Apogee: _____ km Perigee: _____ km
Inclination: _____ deg.
- High Energy requirements: C^3 : _____ km^2/sec^2 DLA: _____ deg RLA: _____ deg
- Proposed LV Performance: _____
- Mass (including reserves) Dry Mass: _____ kg Wet Mass: _____ kg
- Dry Mass Margin: _____ kg _____ %
- Wet Mass Margin _____ kg _____ %
- Formulas:
 - Mass Margin kg = LV Performance – S/C Mass (including reserves)
 - Mass Margin % = $[(\text{Mass Margin kg}) / \text{S/C Mass (including reserves) kg}] \times 100$
- LV Performance Comments/issues/concerns:



Evaluation



- Launch Service Cost Assessment: Area of concern (Yes or No)
 - Is there additional funding for any mission unique modifications/ services? (Yes or No)
- LV Integration: Area of concern (Yes or No)
 - Does the proposer have experience in LV integration? (Yes or No)
- LV to Spacecraft Interface: Area of concern (Yes or No)
 - Proposed Payload Fairing (PLF) _____
 - Spacecraft (S/C) Dimensions: Radial: _____ m Height _____ m
 - Any intrusions outside of the PLF usable Static volume? (Yes or No)
 - Mechanical Interface:
 - Standard Adapter: _____ Custom Adaptor: _____
 - Electrical Interface:
 - Standard _____ Pin(s) Connector(s): (Yes or No)



Evaluation



- LV to Spacecraft Interface: Area of concern (Yes or No)
- Mission Unique requirements:
 - Instrument T-0 GN² Purge: (Yes or No)
 - T-0 S/C Battery Cooling: (Yes or No)
 - Planetary Protection Requirements: (Yes or No)
 - Contamination Control Requirements: PLF: (Yes or No) LV adapter: (Yes or No)
 - Cleanliness Level: _____ other: _____
 - Unique Facility Requirements: (Yes or No)
 - » Pad: _____
 - » S/C Processing Facility: _____
 - S/C Environmental Test Plans
 - » Environmental Test Plan/Flow described: (Yes or No)
 - » Test Levels provided: (Yes or No)
 - » Test Schedule provided: (Yes or No)
 - » Comments/issues/concerns: _____



Evaluation



- Spacecraft Schedule: Area of concern (Yes or No)
 - Adequate timing of: Launch Service Integration Start Time: (Yes or No)
 - S/C Environmental Test Program: (Yes or No)
 - Delivery of Verified S/C Model: (Yes or No)
 - S/C ship date: (Yes or No)
 - S/C to LV integrated Operations: (Yes or No)
- Missions with Radiological material Area of concern (Yes or No)
 - List the Radiological Sources:

 - Are unique facilities required to store/process the Radiological Sources? (Yes or No)
 - Any LV modifications required for additional safety or Launch approval? (Yes or No)